

Amendments to the Claims

Please amend Claim 109. The Claim Listing below will replace all prior versions of the claims in the application:

Claim Listing

1-108 (Canceled)

109. (Currently Amended) A method of monitoring damage at a fastener through [a] the test substrate comprising:

mounting respective spatially periodic field eddy-current sensors to the test substrate at both ends of a fastener; and

sensing response of the test substrate to a magnetic field imposed by the eddy-current sensors.

110. (Canceled)

111. (Previously Presented) A method as claimed in Claim 109 where the damage is in the form of a crack.

112. (Previously Presented) A method for monitoring damage at a fastener comprising:

mounting at least two eddy-current sensor arrays on a test substrate around respective fasteners;

connecting drive and sense conductors of the eddy-current sensors with a single cable to a data acquisition system; and

sensing response of the test substrate to a magnetic field imposed by the eddy-current sensors.

113. (Original) A method as claimed in Claim 112 where the each sensor provides a separate output.

- 114. (Original) A method as claimed in Claim 113 where the output is an absolute property measurement.
- 115. (Currently Amended) A method as claimed in Claim 161 where sense conductors of ~~pairs of sensing elements~~ the at least two eddy-current sensor arrays are connected together to provide a differential measurement.
- 116. (Original) A method as claimed in Claim 112 where separate drive connections are made to each sensor.
- 117. (Original) A method as claimed in Claim 116 where the sense conductors are connected together to provide a common output connection.
- 118. (Original) A method as claimed in Claim 112 where the drive conductors are connected together to provide a common drive signal.
- 119. (Original) A method as claimed in Claim 118 where the sense conductors are connected together to provide a common output connection.
- 120. (Canceled)
- 121. (Previously Presented) A method as claimed in Claim 162 where the test substrate withstands compressive loads.
- 122-144 (Canceled)
- 145. (Previously Presented) A method for monitoring damage at a fastener comprising:
 - mounting a spatially periodic field eddy-current sensor array to a test substrate under the head of a fastener; and

sensing response of the test substrate to a magnetic field imposed by the eddy-current sensor array.

146. (Previously Presented) A method for performing fatigue testing at a fastener comprising:
mounting an eddy current sensor array to a test substrate under the head of a fastener; and

sensing response of the test substrate to a magnetic field imposed by the eddy-current sensor array.

147. (Previously Presented) A method of monitoring damage at a fastener comprising:
mounting a spatially periodic field eddy-current sensor array to a structure near a fastener, the sensor being mounted between layers of the structure attached by the fastener; and

sensing response of the test substrate to a magnetic field imposed by the eddy-current sensor array.

148. (Currently Amended) A method of monitoring damage at a fastener comprising:
mounting a spatially periodic field eddy-current sensor array to a test coupon specimen, the sensor being mounted between layers of the test coupon attached by the fastener; and

sensing response of the test coupon specimen to a magnetic field imposed by the eddy-current sensor array.

149. (Previously Presented) A method for performing fatigue testing at a fastener comprising:
mounting an eddy current sensor array to a test substrate under the head of a fastener; and

sensing response of the test substrate to a magnetic field imposed by the eddy-current sensor array.

150. (Previously Presented) A method of monitoring damage at a fastener comprising:

mounting a spatially periodic field eddy-current sensor array to a structure near a fastener, the sensor array being mounted between layers of the structure attached by the fastener; and

sensing response of the test substrate to a magnetic field imposed by the eddy-current sensor array, each eddy-current sensor having at least two drive conductors and the current changing direction in at least one conductor.

151. (Currently Amended) A method of monitoring damage at a fastener comprising:

mounting a spatially periodic field eddy-current sensor array to a structure near a fastener, the sensor being mounted between layers of the structure attached by the fastener;

sensing response of the ~~test substrate~~ structure to a magnetic field imposed by the eddy-current sensor; and

calibrating each sense element of the eddy-current sensor array by adjusting the response to an appropriate level.

152. (Currently Amended) A method as claimed in Claim 151 where the calibration involves placing the sensor on the test ~~material~~ structure and measuring the response of each sense element.

153. (Previously Presented) A method as claimed in Claim 152 where the calibration further involves a second response measurement for each sense element with a nonconductive material placed between the sensor and the test material.

154. (Previously Presented) A method as claimed in Claim 152 wherein the calibration includes varying the temperature of the test material.

155. (Currently Amended) A method of monitoring damage at a fastener comprising:

mounting a spatially periodic field eddy-current sensor array to a structure near a fastener, the sensor being mounted between layers of the structure attached by the fastener; and

sensing response of the ~~test-substrate~~ structure to a magnetic field imposed by the eddy-current sensor array, each eddy current sensor having a periodic magnetic field produced by linear segments of ~~the~~ its drive winding.

156. (Currently Amended) A method of monitoring damage at a fastener comprising:
 - mounting an eddy-current sensor array to a structure near a fastener, the sensor being mounted between layers of the structure attached by the fastener; and
 - sensing response of the ~~test-substrate~~ structure to a magnetic field imposed by the eddy-current sensor array, the sensor array having a magnetic field produced by a drive winding formed from concentric conductors within the same plane.
157. (Currently Amended) A method as claimed in Claim 148 wherein the sensor is thin and conforms to the shape of the ~~structure~~ test specimen.
158. (Previously Presented) A method as claimed in Claim 148 wherein the sensor is mounted using an adhesive.
159. (Currently Amended) A method as claimed in Claim 148 wherein the sensor is mounted by pressing the sensor against the surface of the ~~structure~~ test specimen and using pressure to hold the sensor in place, the pressure being provided by an opposing surface whose shape matches the shape of the ~~structure~~ test specimen.
160. (Previously Presented) A method as claimed in Claim 145 where at least one sensor is a circular spatially periodic field sensor.
161. (Previously Presented) A method as claimed in Claim 112 where the drive conductors of at least two sensors are connected in series.

162. (Previously Presented) A method for monitoring damage at a fastener comprising:
 mounting a spatially periodic field eddy current sensor array with a cylindrical support material shaped in the form of a washer;
 mounting the cylindrical support to a test substrate under a fastener head; and
 sensing response of the test substrate to a magnetic field imposed by the eddy-current sensor.
163. (Previously Presented) A method as claimed in Claim 146 where the sensor further comprises a drive having at least two conductors where the current changes direction in at least one conductor.
164. (Currently Amended) A method as claimed in Claim 145 where at least one ~~sensing element~~ eddy-current sensor is placed in an area likely to see damage and at least one ~~sensing element~~ eddy-current sensor is placed in an area unlikely to see damage.
165. (Previously Presented) A method for monitoring damage under the head of a fastener comprising:
 mounting an eddy current sensor array to a test substrate under the head of a fastener with sense elements located at different radial distances from the fastener center;
 and
 sensing response of the test substrate to a magnetic field imposed by the eddy-current sensors.
166. (Previously Presented) A method for monitoring damage under the head of a fastener comprising:
 mounting an eddy current sensor array to a test substrate under the head of a fastener with sense elements located at different circumferential positions around the fastener; and
 sensing response of the test substrate to a magnetic field imposed by the eddy-current sensors.

167. (Currently Amended) A method of monitoring damage at a fastener comprising:
 mounting an eddy-current sensor array to a structure near a fastener, the sensor being mounted between layers of the structure attached by the fastener with at least one sensing element placed in an area likely to see damage and at least one sensing element placed in an area unlikely to see damage; and
 sensing response of the ~~test-substrate~~ structure to a magnetic field imposed by the eddy-current sensors.
168. (Currently Amended) A method of monitoring damage at a fastener comprising:
 mounting an eddy-current sensor array to a structure near a fastener, the sensor being mounted between layers of the structure attached by the fastener with sense elements located at different radial distances from the fastener center; and
 sensing response of the ~~test-substrate~~ structure to a magnetic field imposed by the eddy-current sensors.
169. (Currently Amended) A method of monitoring damage at a fastener comprising:
 mounting an eddy-current sensor array to a structure near a fastener, the sensor being mounted between layers of the structure attached by the fastener with sense elements located at different circumferential positions around the fastener; and
 sensing response of the ~~test-substrate~~ structure to a magnetic field imposed by the eddy-current sensors.
170. (Currently Amended) A method as claimed in Claim 109 ~~wherein~~ wherein at least one ~~sensing elements~~ sensor from the eddy-current sensors is placed in an area likely to see damage and at least one sensing element is placed in an area unlikely to see damage.
171. (Currently Amended) A method as claimed in Claim 109 ~~wherein~~ wherein the ~~sense elements~~ eddy-current sensors are located at different radial distances from the fastener center.

172. (Currently Amended) A method as claimed in Claim 109 ~~wherein~~ wherein the ~~sense elements~~ eddy-current sensors are located at different circumferential positions around the fastener.
173. (Currently Amended) A method as claimed in Claim 112 ~~wherein~~ wherein at least one eddy-current sensor is placed in an area likely to see damage and at least one ~~sense elements~~ eddy-current sensor is placed in an area unlikely to see damage.
174. (Currently Amended) A method as claimed in Claim 112 ~~wherein~~ wherein the ~~sense elements~~ eddy-current sensors are located at different radial distances from the fastener center.
175. (Currently Amended) A method as claimed in Claim 112 ~~wherein~~ wherein the ~~sense elements~~ eddy-current sensors are located at different circumferential positions around the fastener.
176. (Previously Presented) A method for monitoring damage at a fastener comprising:
 mounting an eddy-current sensor array with a cylindrical support material shaped in the form of a washer with at least one sensing element placed in an area likely to see damage and at least one sensing element placed in an area unlikely to see damage;
 mounting the cylindrical support to a test substrate under a fastener head; and
 sensing response of the test substrate to a magnetic field imposed by the eddy-current sensor array.
177. (Previously Presented) A method for monitoring damage at a fastener comprising:
 mounting an eddy-current sensor array with a cylindrical support material shaped in the form of a washer the sense elements being located at different radial distances from the fastener center;
 mounting the cylindrical support to a test substrate under a fastener head; and

sensing response of the test substrate to a magnetic field imposed by the eddy-current sensor array.

178. (Previously Presented) A method for monitoring damage at a fastener comprising:
 - mounting an eddy-current sensor array with a cylindrical support material shaped in the form of a washer the sense elements being located at different circumferential positions around the fastener;
 - mounting the cylindrical support to a test substrate under a fastener head; and
 - sensing response of the test substrate to a magnetic field imposed by the eddy-current sensor array.
179. (Previously Presented) A method for monitoring damage at a fastener comprising:
 - mounting at least two eddy-current sensor arrays on a test substrate around fasteners;
 - connecting drive windings of the eddy-current sensor arrays in series; and
 - sensing a response of the test substrate to a magnetic field imposed by the eddy-current sensor arrays.
180. (Previously Presented) A method as claimed in Claim 179 wherein each sensor has one or more sensing elements.
181. (Previously Presented) A method as claimed in Claim 180 where the response from all of the sensing elements are monitored in parallel at essentially the same time.
182. (Previously Presented) A method as claimed in Claim 179 where the sensors are used to monitor material properties at different locations to detect response changes.
183. (Previously Presented) A method as claimed in Claim 182 where the changes in the response are related to damage in material.

184. (Previously Presented) A method as claimed in Claim 182 where the response is used to detect the initiation of a crack.
185. (Previously Presented) A method as claimed in Claim 182 where the response is used to monitor the growth of a crack.
186. (Previously Presented) A method as claimed in Claim 182 where the response is used to estimate the length of a crack.
187. (Previously Presented) A method as claimed in Claim 111, wherein an action is taken at a predetermined sensor response level.
188. (Currently Amended) A method as claimed in Claim 145, wherein the test substrate is a test ~~coupon~~ specimen.
189. (Currently Amended) A method as claimed in Claim 146, wherein the test substrate is a test ~~coupon~~ specimen.
190. (Currently Amended) A method as claimed in Claim 147, wherein the test substrate is a test ~~coupon~~ specimen.
191. (Previously Presented) A method as claimed in Claim 156, wherein there is one or more sense elements per each conductor.

Amendments to the Drawings

Figures 26 and 28 have been amended and a new figure 28B has been added. The amended drawings include elements previously described and claimed in this application. No new matter has been added.

Attachment: Replacement Sheets
Annotated Marked-Up Drawings
New FIG. 28b